Effect of Obesity on Progress of Labor

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Abstract: Background: Obesity is a major public health challenge that affects almost every country in the world. Globally, obesity rates have been increasing steadily over the last three decades. Maternal obesity has been associated with multiple comorbidities and a higher risk of obstetric and peripartum complications, such as prolonged labor and increased CS. The purpose of the present study was to assess effect of obesity on progress of labor. Design: A descriptive research design was used. Sample: A purposive sample of 370 laboring women was divided into two groups: the obese group and the normal-weight women group. Each group had 185 participants. Settings: The study was conducted at the obstetric departments of the University Hospital and Shebin El-Kom Teaching Hospital in Menoufia Governorate. Instruments of this study were a structured interview questionnaire that included sociodemographic characteristics of women (name, age, education, and occupation), menstrual, obstetric, medical surgical history, weight, height, BMI...etc.) and a partogram to assess the progress of labor. Results: There was a lower mean duration of the latent and active phases (first stage), second stage and total duration of labor in the normal-weight women than in the obese women. Also, the mean dose of oxytocin during the first stage of labor was lower in the normal-weight women than in the obese women. Nearly half of the obese women had CS delivery, compared to only one-third in the normal weight women. Conclusion: Obese women had prolonged labor duration, slow progress of labor, and a higher rate of CS delivery than normal weight women. Recommendations Encourage the maternity nurses to include health teaching for obese laboring women during antenatal counseling, such as a healthy diet and exercise to reduce their weight and distribute colorful brochures regarding the negative impact of obesity on pregnancy and labor and its preventive measures to both nurses and women. Also, encourage the maternity nurses to use the partogram in the labor units.

Keywords: Maternal Obesity, Progress of labor.
Introduction

Riley et al. (2018) in their study about “Obesity in pregnancy: risks and management” in America stated that the worldwide prevalence of obesity has increased over the past few decades. They added that economic, technological, and lifestyle changes have created an abundance of unhealthy, high-calorie food coupled with decreased required physical activity.

Based upon the World Population Review 2020, Egypt ranked as the highest 19th highest country in the world and the 7th highest country in the Arab region, with a 32% obesity rate. Additionally, Sedky et al. (2021) in their study about “Combating the High Prevalence of Obesity among Egyptian Households: A Pilot Study: Port-Said Households” stated that obesity is a major public health issue in Egypt, and its repercussions are not only limited to the health dimension, but also extend to affecting the productive capacity of the citizens. They also added that according to the “100 million Seha” initiative, 39.8% of Egyptian adults suffer from obesity.

Likewise, Strauss (2021) in his study about “Obesity in Pregnant Women: Maternal, Fetal, and Transgenerational Consequences” in UK, Europe showed that women are an integral part of this overflowing wave of obesity. Therefore, they revealed that maternal obesity can result in negative outcomes for both women and fetuses. Also, they added that the maternal risks during pregnancy include gestational diabetes and preeclampsia and the fetus is at risk for stillbirth and congenital anomalies.

Azaïs et al. (2017) conducted their study about “Effects of Adipokines and Obesity on Uterine Contractility” in France showed that it is important to have knowledge about the effect of obesity on the progress of labor to help obstetricians take measures to avoid complications during childbirth. According to Zhang & Duan et al. (2018) in their study about “the Physiologic Pattern of Normal Labor Progression” showed that progress in labor is determined by assessing the four following components also known as the four Ps: (power, passenger, passage and psyche). They added that power refers to uterine contraction, Passenger refers to the fetus and placenta, Passageway refers to the pathway the fetus takes out of the mother’s body (pelvis and related structures), and Psyche refers to woman’s emotional state. Also, they added that all of these must work together in synchronicity to achieve a successful vaginal birth.

In addition, Shahrir et al. (2021) in their study about “Maternal Obesity and its Associated Factors and Outcomes in Klang Valley, Malaysia:” reported that labor complications arise more often when pregnancies are complicated by overweight and obesity. Also, they added that that labor is complicated by uterine dysfunction, which affects the quality of labor.

Moreover, Kyozuka et al. (2022) in their study about “Gestational Weight Gain as a Risk Factor for Dystocia during First Delivery: A multicenter Retrospective Cohort Study in Japan” stated that a pre-pregnancy BMI > 30.0 kg/m2 was an independent risk factor for dystocia (an abnormality in the progression of labor). Also, they added that dystocia is one of the most common obstetric complications among nulliparous women for which medical intervention is justified because dystocia is associated with operative vaginal delivery and cesarean section (CS).
Significance of the study:

Alebshehy et al., (2016) in their study about “Determinant Analysis of Obesity among Adult Females in Egypt” stated that there is a remarkable increase in obesity with more than one-third of the whole population being obese in Egypt. They added that a particular issue in Egypt is that the prevalence of obesity is more than double among females (46%), as compared to males (22%). Moreover, there is no national program to address the problem, and 95% of these females are not taking any measures to change their weight.

Additionally, Angeliki et al (2018) in their study about “Maternal Obesity and its Association with the Mode of Delivery and the Neonatal Outcome in Induced Labor: Implications for Midwifery Practice” in Europe revealed that maternal obesity contributes to a substantial proportion of obstetric complications and adverse outcomes. Also, they reported that increasing cesarean-section delivery was associated with increasing BMI in women with induced labor.

Moreover, Azaïs et al (2017) conducted their study about “Effects of a Dipokines and Obesity on Uterine Contractility” in France, which showed that better knowledge of the impact of obesity on labor pathophysiology should strengthen the prevention of obesity complications in women of childbearing age and provide suitable and effective management. So, this study aimed to assess the effect of obesity on the progress of labor.

Definition of variable

Obesity is the accumulation of an excess of energy stored in the form of excess body fat. This excess results from the fact that the energy obtained from the diet is superior to the energy used, resulting in energy balance dysregulation, which is due to complex and multifactorial aetiologies (Ghanem & St-Amand, 2018). While in this study, obesity is operationally defined as pregnant women having a body mass index of 30 or higher, and this high BMI is acquired before pregnancy. This will be assessed by (instrument I).

The progress of labor is determined by the assessment of four components (four Ps): power, which is the strength of uterine contraction; passenger, which is the size and position of the fetus; passage, which is awareness of the adequacy of the pelvis; and psych, which is the emotional state of the mother during labor (Thornton et al., 2020). While in this study, the progress of labor is operationally defined as measuring the progress of labor by partogram (instrument II), which measures two factors: power (the strength of uterine contraction) and passenger (size and position of the fetus), and the nurse will determine if there is normal progress of labor or if there is any deviation or deterioration and will take timely intervention.

Purpose of the study

The present study’s purpose is to assess effect of obesity on progress of labor.

Research Questions

1) What is the effect of obesity on progress of labor?
2) Are there differences between obese and normal weight women in the occurrence of complications during labor?
3) What is the correlation between body mass index and cervical dilation?
4) What is the correlation between body mass index and oxytocin requirement?
Method

Research design:
A descriptive design was used to carry out this study.

Research Setting:
The study was conducted in two settings: the obstetric departments at the University Hospital and Shebin El-Kom Teaching Hospital in Menoufia Governorate.

Sample size estimation:
Based on the review of past literature (Valente et al., 2020), who found that obese women had a few cases of normal vaginal delivery (28.9 versus 32.9%), (P = 0.03). The sample was calculated using the following equation: \( N = \frac{r+1(P)(1-P)(Z\beta + Z\alpha/2)^2}{r(P1-P2)^2} \) where \( r \) is the ratio between cases and controls, \( P \): proportion in cases and controls, \( P1-P2 \) is effect size, \( Z\alpha/2 \) is the standard normal variate at 5% type I error, and \( Z\beta \) is the standard normal variate at power 80%; it equals 0.84. The sample was calculated at a power of 80% and a confidence level of 95%. The calculated sample was \( N = 1+1(0.175)(0.82)(0.84+1.96)2 \mid 1 \) \( = 0.287 \times 7.84 \times 0.0121 \) = 185 per group, for a total sample of 370 laboring women divided into two groups of 185 each: obese group and control group, each with 185 participants.

Sample type:
A purposive sample of 370 laboring women was divided into two groups: the obese group and the normal-weight women group. Each group has 185 participants.

The inclusion criteria for the sample are as follows:
1) Primiparous women (Obese and normal-weight women).
2) Age 20-40 years.
3) Cephalic occipital-anterior position in the first stage of labor

The exclusion criteria for the sample are as follows:
1) Multiparous women.
2) High risk pregnancy (Mal presentation, chronic disease)

Instruments for data collection consisted of:

Instrument I: Structured interview questionnaire (Appendix A):
This questionnaire was developed by the researcher based on pertinent literature and the guidance of the supervisors and was subjected to validity and reliability measures and a pilot study. It consisted of socio-demographic and medical characteristics of women (age, education, occupation, menstrual, obstetric, medical-surgical history, etc.) and other data such as weight and height to calculate BMI.

Table 1: BMI classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese</td>
<td>≥30.0</td>
</tr>
<tr>
<td>Overweight</td>
<td>25-29.9</td>
</tr>
<tr>
<td>Normal weight</td>
<td>&lt;25</td>
</tr>
<tr>
<td>Underweight</td>
<td>&lt;18.5</td>
</tr>
</tbody>
</table>


Validity of the Instrument:
For validity purposes, the researcher adopted this instrument after reviewing the current national and international related literature using books, articles, and scientific journals and developed the questionnaire from the previously
used instrument. The questionnaire was formulated and cross-checked for content validity by three experts in maternity nursing and medicine who field-tested its validity. The modifications needed were made according to the experts' suggestions.

**Reliability of the instrument:**

The researcher would use reliability to test the instrument’s internal consistency by administering the same instrument to the same respondents under identical conditions on one or more occasions.

**Instrument II: Partogram to assess the progress of labor (Appendix B):**

A partogram is a pictorial or graphical record of key maternal and fetal events in labor plotted against time on a single sheet of paper (Sara & Lack, 2022). The UK National Institute for Health and Care Excellence (NICE) recommends a system to record the key events of labor, and the latest World Health Organization (WHO) modified partogram has been incorporated as an essential birthing record tool in many maternity hospitals.

According to WHO (2007) and Mitchell (2010), most partograms contained fetal and maternal records in addition to cervical dilation. The fetal record might track the fetal heart rate, the descent of the fetal presentation part, the condition of amniotic fluid and the molding of the fetal skull. The maternal record includes temperature, heart rate, blood pressure, urine (for protein and ketones), uterine contraction, and the use of medications (such as oxytocin). This form allowed health care providers to record, interpret, analyze, and use data to make decisions on labor management. Alerts and action lines were printed on the partogram for the active phase of labor. An alert line started at 4 cm of cervical dilation and extended to the point of expected full dilation at the rate of 1 cm/h. In the active phase of labor, the plotting of cervical dilation normally remained on or to the left of the alert line. When dilation crossed to the right of the alert line, it was a warning that labor may be prolonged. The action line is parallel and four hours to the right of the alert line. When cervical dilation crosses this line, action must be taken immediately.

**Validity of the Instrument:**

The researcher adopted this instrument which is validated by WHO.

**Reliability of the instrument:**

Tested and retested for reliability on the studied women.

**Pilot Study:**

A pilot study was implemented to test the applicability of the instruments, the feasibility of the study, and the time needed for data collection. It was performed on 10% of the total participants, which are 37 participants.

**Ethical considerations**

The protocol approved by the Ethical and Research Committee of Menoufia University's Faculty of Nursing on May 18, 2022. A written consent was obtained from maternity nurses regarding their approval to share in the study. They were assured of the confidentiality and anonymity of the collected data.

**Administrative Approval Letters:**

Official letters were taken from the Dean of the Faculty of Nursing at Menoufia University and submitted to the directors of the University Hospital and Shebin El-Kom Teaching Hospital at Menoufia Governorate before the start of data collection to carry out the study. Official permission was obtained from the directors of the above-mentioned settings to carry out
the study. A full explanation of the rationale of the present study was provided to the directors of the study settings.

**Study Field Work:**

- The data collection for the study took five months, from November 2022 to the end of March 2023.
- The researcher visited the previously mentioned settings three days a week (Saturday, Monday, and Thursday) at Menoufia University Hospital and on Sunday, Tuesday, and Thursday at Shebin El-Kom Teaching Hospital.

**The study was conducted according to the following phases:**

**Preparatory Phase**

An extensive review related to the study area was done including electronic dissertations, available books, articles, and periodicals. A review of the literature to formulate a knowledge base relevant to the study area was also done.

**Interviewing and Assessment Phase**

- Official permission to carry out the study was obtained from the director of each setting after submitting a letter from the Dean of the Faculty of Nursing explaining the study’s purpose and the data collection method.
- At the study's beginning, the researcher introduced herself and explained its purpose and nature to the participants.
- Oral consent from the participants who participated in the study was obtained.
- Women who fulfilled the inclusion criteria came to the previously stated hospital during the first stage of labor. They were recruited and monitored the first stage of labor until the end of labor. The researcher presented to the obstetric department from 9 a.m. to 3 p.m. and interviewed about 1-2 women in the presenting days. The researcher introduced herself to them, provided a verbal explanation of the study, and answered all questions. Then they were to complete the socio-demographic characteristics, BMI (the study focused on pre-pregnancy weight that had been recorded in the first antenatal visit record), data about current pregnancy, and current labor.

**Initial assessment and examination of the woman**

The researcher started to collect data through general, abdominal, and vaginal examinations, which were obtained from the woman's records.

**General physical examination**

The researcher assessed the general condition by taking vital signs (temperature, pulse, respiration, and blood pressure), assessed the degree of labor pain by NRS, and assessed the patient’s response to cope with pain.

**Abdominal examination**

An abdominal examination was performed to determine the fundal level, lie, presentation, position, and attitude of the fetus, as well as the fetal heart sound.

**Vaginal examination**

The vaginal examination was performed for all subjects upon admission and then every hour to determine cervical dilation, effacement, station, and the presenting part, which was done by the physician.
Continuous assessment and monitoring of labor progress using a partograph

The researcher used the partograph to assess the following:

a) Fetal condition: the fetus was monitored closely on the partograph by the regular observation of the fetal heart rate using sonicaid. This was repeated and recorded every 30 minutes. Liquor and the moulding of the fetal skull bones was assessed through vaginal examination.

b) Progress of labor was assessed through uterine contractions for intensity, duration, frequency, and descent of the fetal head via abdominal examination, and cervical dilation via vaginal examination.

c) Maternal condition: regular assessment of the woman’s condition was achieved by recording the woman's vital signs (temperature, pulse, respiration, and blood pressure) and by charting the administration of drugs, fluids, oxytocin, and urine output.

Then the researchers observed and monitored the women during the second and third stages of labor and observed if any complications occurred to the mother or the fetus during the stages of labor for both obese and normal-weight women to be able to assess the effect of obesity on the progress of labor.

Statistical Analysis:

Data was collected, entered, tabulated, and statistically analyzed using an IBM personal computer with Statistical Package for Social Science (SPSS) version 22 (SPSS, Inc., Chicago, Illinois, USA). Graphics were done using Excel programs.

Quantitative data were presented as mean (X) and standard deviation (SD). It was analyzed using the student t-test for comparison between two means and the ANOVA (F) test for comparison between more than two means.

Qualitative data were presented in the form of frequency distribution tables, numbers, and percentages. It was analyzed by a chi-square ($\chi^2$) test to study the association between the two qualitative variables. However, if the expected value of any cell in the table was less than 5, the Fisher exact test was used (if the table was 4 cells) or the likelihood ratio (LR) test (if the table was more than 4 cells). The level of significance was set at a P value <0.05 for all significant tests. Pearson’s correlation (r) test to measure the association between quantitative variables.

- A P value > 0.05 was considered statistically nonsignificant.
- A P value < 0.05 was considered statistically significant.
- A P value < 0.001 was considered statistically highly significant.

Limitations of the study

- The size of the study population.
- BMI was recorded in early pregnancy and this study can therefore not account for the effect of gestational weight gain on labour duration or outcome.
- Gestational age at the first prenatal visit was not recorded; however, most women attended visits early in their pregnancy, as is standard practice.

Results

Table (1) shows the demographic data and medical history of the studied women. As evident from the table, there were no statistically significant differences between the normal-weight women group and the obese group regarding the demographic data and medical history in terms of age, educational level, occupation, monthly
income, marriage duration, and the presence of any chronic diseases. Table (2) reflects the mean and standard deviation of the studied women according to their physical measurements. It showed that there were statistically significant differences between the normal-weight group and the obese group regarding all physical measurements. Furthermore, the mean of current weight, the mean weight before pregnancy, the weight gain during pregnancy, and the body mass index were lower in the normal-weight group than in the obese group.

Table (3) illustrates that there were statistically significant differences among the studied women regarding the progress of labor at a P-value of 0.000. Meanwhile, there were lower mean durations of the latent and active phases, first stage, second stage, third stage, total duration of labor and the mean dose of oxytocin during the first stage of labor in the normal-weight group than the obese group.

Table (4) illustrates that all studied women had shown on admission and there were statistically significant differences among the obese and normal weight women regarding the occurrence of complications during childbirth. Where prolonged first stage and arrest of cervical dilation were higher in obese group (40.7% & 59.3% respectively) than in the normal weight group (12.9% & 20.6% respectively). In addition, obstructed labor was higher in the obese group (15.1%) than the normal weight group (4.9%). Also, Perineal tear, Macrosomia, Shoulder dystocia, and fetal distress were higher in obese group (5.9%, 5.4%, 5.4% and 2.5% respectively) than in the normal weight group (2.7%, 0.5%, 0.5% and 1.6% respectively).

Figure (1) depicts the relationship between BMI and cervical dilatation rate. There was a highly significant negative correlation between the body mass index and the cervical dilatation rate. It means that as the body mass index increases, the rate of cervical dilatation decreases.

Figure (2) depicts the relationship between BMI and the total duration of labor. There was a highly significant positive correlation between the body mass index and the total duration of labor. It means that as the body mass index increases, the total duration of labor increases.

Table 5 shows the correlation between body mass index and gestational age. There was a positive correlation between body mass index and gestational age (P = 0.000).

Table 6 shows the correlation between body mass index and oxytocin dose. There was a positive correlation between body mass index and oxytocin dose (P > 0.05).
Effect of Obesity on Progress of Labor

Table 1: Demographic Data and Medical History of the Studied Women (N = 370)

<table>
<thead>
<tr>
<th>Items</th>
<th>The studied women</th>
<th>X2</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal-weight women group (N = 185)</td>
<td>Obese group (N = 185)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤30</td>
<td>73</td>
<td>39.5</td>
<td>86</td>
</tr>
<tr>
<td>31-40</td>
<td>112</td>
<td>60.5</td>
<td>99</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>31.86±4.21</td>
<td></td>
<td>29.27 ± 4.41</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>21</td>
<td>11.4</td>
<td>18</td>
</tr>
<tr>
<td>Read and write</td>
<td>11</td>
<td>5.9</td>
<td>18</td>
</tr>
<tr>
<td>Preparatory school</td>
<td>9</td>
<td>4.9</td>
<td>9</td>
</tr>
<tr>
<td>Secondary education</td>
<td>60</td>
<td>32.4</td>
<td>55</td>
</tr>
<tr>
<td>University</td>
<td>84</td>
<td>45.4</td>
<td>85</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housewife</td>
<td>122</td>
<td>65.9</td>
<td>115</td>
</tr>
<tr>
<td>Employee</td>
<td>63</td>
<td>34.1</td>
<td>70</td>
</tr>
<tr>
<td>Monthly income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enough</td>
<td>151</td>
<td>81.6</td>
<td>163</td>
</tr>
<tr>
<td>Not enough</td>
<td>34</td>
<td>18.4</td>
<td>22</td>
</tr>
<tr>
<td>Marriage duration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than a year</td>
<td>34</td>
<td>18.4</td>
<td>19</td>
</tr>
<tr>
<td>1–2 years</td>
<td>87</td>
<td>47.0</td>
<td>97</td>
</tr>
<tr>
<td>2–3 years</td>
<td>57</td>
<td>30.8</td>
<td>61</td>
</tr>
<tr>
<td>4 years or more</td>
<td>7</td>
<td>3.8</td>
<td>8</td>
</tr>
<tr>
<td>Do you have any chronic diseases</td>
<td>185</td>
<td>100.0</td>
<td>185</td>
</tr>
</tbody>
</table>

Table 2: Mean and Standard Deviation of the Studied Women According to Their Physical Measurements (N = 370)

<table>
<thead>
<tr>
<th>Items</th>
<th>The studied women</th>
<th>t. Test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal-weight women group (N = 185)</td>
<td>Obese group (N = 185)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td></td>
</tr>
<tr>
<td>Current weight (kg)</td>
<td>75.94 ± 5.42</td>
<td>99.67 ± 4.77</td>
<td>44.682</td>
</tr>
<tr>
<td>Weight before pregnancy (kg)</td>
<td>63.87 ± 4.22</td>
<td>82.21 ± 3.87</td>
<td>43.528</td>
</tr>
<tr>
<td>Weight gain during pregnancy (kg)</td>
<td>11.87 ± 2.60</td>
<td>17.49 ± 2.20</td>
<td>22.415</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>161.66 ± 3.77</td>
<td>161.58 ± 1.53</td>
<td>-.271</td>
</tr>
<tr>
<td>Body mass index: weight (kg)/height (m)</td>
<td>24.36 ± 0.61</td>
<td>31.54 ± 1.72</td>
<td>53.382</td>
</tr>
</tbody>
</table>
Effect of Obesity on Progress of Labor

Table 4: Progress of Labor among the Studied Women (N = 370)

<table>
<thead>
<tr>
<th>Items</th>
<th>The studied women</th>
<th>t. Test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal-weight</td>
<td>Obese</td>
<td></td>
</tr>
<tr>
<td></td>
<td>women group (N =</td>
<td>group (N =</td>
<td></td>
</tr>
<tr>
<td>Cervical dilatation on admission (cm)</td>
<td>185)</td>
<td>185)</td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>4.36 ± 0.37</td>
<td>4.45 ± 0.50</td>
<td>1.978</td>
</tr>
<tr>
<td>Duration of the latent phase (hours)</td>
<td>9.46 ± 1.69</td>
<td>11.25 ± 1.46</td>
<td>10.814</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>6.85 ± 2.29</td>
<td>6.73 ± 8.37</td>
<td>21.30</td>
</tr>
<tr>
<td>Duration of the first stage of labor (hours)</td>
<td>14.72 ± 3.13</td>
<td>16.85 ± 5.45</td>
<td>4.595</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>1.04 ± 0.94</td>
<td>1.46 ± 3.76</td>
<td>12.57</td>
</tr>
<tr>
<td>Duration of the third stage of labor (min)</td>
<td>6.32 ± 4.90</td>
<td>5.83 ± 6.87</td>
<td>2.217</td>
</tr>
<tr>
<td>Total duration of labor (hour)</td>
<td>9.76 ± 6.98</td>
<td>10.43 ± 9.47</td>
<td>48.46</td>
</tr>
<tr>
<td>What is the dose of oxytocin during the first stage of labor? (IU)</td>
<td>6.24 ± 2.16</td>
<td>8.10 ± 2.43</td>
<td>7.788</td>
</tr>
</tbody>
</table>

Table 5: The Occurrence of Complications during Childbirth among the Studied Women (N = 370) all studied women had show on admission.

<table>
<thead>
<tr>
<th>Items</th>
<th>The studied women</th>
<th>X2</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal-weight</td>
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<tr>
<td></td>
<td>women group (N =</td>
<td>group (N =</td>
<td></td>
</tr>
<tr>
<td></td>
<td>185)</td>
<td>185)</td>
<td></td>
</tr>
<tr>
<td>Are there any complications related to the progress of labor during the first stage?</td>
<td></td>
<td></td>
<td>77.47</td>
</tr>
<tr>
<td>Yes</td>
<td>62</td>
<td>145</td>
<td>78.4</td>
</tr>
<tr>
<td>No</td>
<td>123</td>
<td>40</td>
<td>21.6</td>
</tr>
<tr>
<td>If the answer is yes, what are they?</td>
<td></td>
<td></td>
<td>.109</td>
</tr>
<tr>
<td>Prolonged first stage</td>
<td>8</td>
<td>59</td>
<td>40.7</td>
</tr>
<tr>
<td>Arrest of cervical dilatation</td>
<td>54</td>
<td>86</td>
<td>59.3</td>
</tr>
<tr>
<td>Are there any complications (maternal or fetal) during the second stage?</td>
<td></td>
<td></td>
<td>96.338</td>
</tr>
<tr>
<td>Yes</td>
<td>37</td>
<td>131</td>
<td>70.8</td>
</tr>
<tr>
<td>No</td>
<td>148</td>
<td>54</td>
<td>29.2</td>
</tr>
<tr>
<td>If yes, what are they?</td>
<td></td>
<td></td>
<td>.000</td>
</tr>
<tr>
<td>Obstructed labor</td>
<td>9</td>
<td>28</td>
<td>15.1</td>
</tr>
<tr>
<td>Perineal tear</td>
<td>2</td>
<td>19</td>
<td>10.3</td>
</tr>
<tr>
<td>Vaginal tear</td>
<td>5</td>
<td>11</td>
<td>5.9</td>
</tr>
<tr>
<td>Postpartum hemorrhage</td>
<td>10</td>
<td>17</td>
<td>9.2</td>
</tr>
<tr>
<td>Macrosomia</td>
<td>1</td>
<td>10</td>
<td>5.4</td>
</tr>
<tr>
<td>Shoulder dystocia</td>
<td>1</td>
<td>10</td>
<td>5.4</td>
</tr>
<tr>
<td>Fetal distress</td>
<td>3</td>
<td>10</td>
<td>2.5</td>
</tr>
<tr>
<td>Cervical dystocia</td>
<td>5</td>
<td>9</td>
<td>4.9</td>
</tr>
<tr>
<td>Stillbirth</td>
<td>0</td>
<td>9</td>
<td>4.9</td>
</tr>
<tr>
<td>NICU admission</td>
<td>1</td>
<td>8</td>
<td>4.3</td>
</tr>
<tr>
<td>Type of delivery</td>
<td></td>
<td></td>
<td>.1091</td>
</tr>
<tr>
<td>Vaginal</td>
<td>125</td>
<td>95</td>
<td>51.4</td>
</tr>
<tr>
<td>Cesarean section</td>
<td>60</td>
<td>90</td>
<td>48.6</td>
</tr>
</tbody>
</table>

Menoufia Nursing Journal, Vol. 8, No. 3, Sep 2023
Effect of Obesity on Progress of Labor

Figure (6): Correlation between Body Mass Index and Cervical Dilatation Rate.

Figure (7): Correlation between Body Mass Index and the Total duration of labor

Table (6): Correlation between Body Mass Index and Gestational Age (N=185).

<table>
<thead>
<tr>
<th>Items</th>
<th>Body Mass Index</th>
<th>R</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestational age</td>
<td></td>
<td>.178*</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table (7): Correlation between Body Mass Index and Oxytocin Dose (N=185).

<table>
<thead>
<tr>
<th>Oxytocin dose</th>
<th>Body Mass Index</th>
<th>R</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxytocin dose</td>
<td></td>
<td>0.076</td>
<td>0.013</td>
</tr>
</tbody>
</table>
Discussion

Regarding the Demographic data and medical history, the findings of the current study showed that there were no statistically significant differences between the two studied groups regarding their demographic data and medical history in terms of age, educational level, occupation, monthly income, marriage duration, and presence of chronic diseases. These findings mean that both study groups were homogenous and comparable in age, educational level, income, marriage duration, and the presence of chronic disease.

These current findings were compatible with those of El-Sayed et al. (2021), who conducted their study entitled “Impact of Maternal Body Mass Index on Progress and Outcome of Labor in Nulliparous Females” at Al-Hussein and Sayed Galal Hospitals, Al-Azhar University, Egypt. They revealed that the study and control groups were comparable in age, educational level, income, marriage duration, and the presence of chronic disease.

Also, these current findings were in line with those of Egwaila et al. (2022), who conducted their study entitled “Effect of Maternal Obesity on Duration of Labor and Mode of Delivery in Primigravida” at Zagazig, Egypt. They showed that there was no significant difference in terms of age between the studied women. Additionally, they added that none of the studied women complained about any chronic diseases.

Regarding the duration of labor during childbirth among the studied women, there were statistically significant differences among the studied women regarding the progress of labor. However, both the latent and active phases lasted longer in obese women than in normal-weight women. Furthermore, women in the obese group had significantly longer first and second stages of labor than women in the normal weight group, with no difference in third stage duration between the two groups.

These findings were in line with Carlhäll (2018), who investigated their study about "maternal obesity, the duration of labor, and the role of leptin in Sweden;” and showed that nulliparous obese women have a higher risk for a prolonged duration of latent and active phases of labor, however, the differences between the BMI categories were more pronounced in the latent phase than the active phase. Additionally, obese women have a higher risk for a prolonged duration of spontaneous and induced labor. Furthermore, these study findings were in accordance with El-Sayed et al. (2021) in Egypt, which showed that the duration of the latent phase is prolonged in obese women group.

Also, these findings were in agreement with Bjork Lund et al.’s (2022) study entitled “is there an Increased Risk of Cesarean Section in Obese Women after Induction of Labor?” in Stockholm and Lundborg et al.’s (2021) study entitled “Association of body mass index and maternal age with first stage duration of labor” in Stockholm-Gotland, Sweden, as well as Salman et al.’s (2022) studies on the “Effect of Body Mass Index on Mode of Delivery and Maternal and Neonatal Complications in Nulliparous Women” in Ain Shams, Egypt, which showed that obese women had a longer time to enter the active phase due to primary dystocia, resulting in a higher rate of Cs in obese women. Also, all previous related studies stated that obesity is associated with a longer duration of the first stage of labor.

Additionally, these findings agreed with Sadiq & Mohsin’s (2018) study.
Effect of Obesity on Progress of Labor

on “the Effect of Maternal Obesity on Mode of Delivery and Duration of Labor in Kuwait” and Khalifa et al.’s (2021) study entitled “Effect of Maternal BMI on Labor Outcomes in Primigravida Women in Minia University Teaching Hospital and Two Private Hospitals in Cairo,” which showed that obese women had slow progress and a longer duration of both the first and second stages of labor. Parallel to the present study findings, the study that was conducted by Frolova et al. (2021) about “Obesity, Second Stage Duration, and Labor Outcomes in Nulliparous Women at Washington University Medical Center,” found that obesity was associated with prolonged duration of the second stage of labor and a higher rate of second stage cesarean.

According to the researcher's point of view, prolonged duration of the first and second stages of labor among obese women could be explained, according to Carvajal & Oporto’s medical justification (2021) in their study about “The myometrium in pregnant women with obesity” that obese women are known to exhibit higher concentrations of adipokines, which may reduce muscle contractility by inhibiting the RhoA/ROCK pathway in the muscle layer. Also, they added that high cholesterol levels of obese pregnant women are known to alter the myometrial membranes, especially the pits, thus inhibiting the functionality of oxytocin receptors and increasing the activity of K+ channels. Changes in myometrial cells and their local environment may reduce myometrial contractility; this could explain the delayed labor and increased rates of CS delivery in obese pregnant women.

Regarding the third stage of labor, the present study revealed no difference in its duration in both groups. This is due to obese women receiving higher doses of oxytocin and more frequent uterine messages.

On the other hand, the previous study findings were inconsistent with Ellekjaer et al.’s (2017) study at the Department of Gynaecology and Obstetrics, Nordsjlands Hospital, University of Copenhagen, Denmark, entitled “the Effect of Maternal Obesity and its Effect on Labor Duration in Nulliparous Women,” which showed that BMI didn't have a big effect on the total length of active labor. Also, the current study findings disagreed with Abdo et al.’s (2018) study entitled “Maternal Obesity and Its Effect in Late Pregnancy and Labor” at Etay El-Baroud General Hospital, Egypt, which showed that BMI did not affect the total duration of the second stage of labor. Also, the study results disagreed with Cummings et al.’s (2018) study about “The Third Stage of Labor in the Extremely Obese Parturient in Canada” which showed that women who are in the "extremely obese" category had a longer third stage of labor.

The contrast between our study and those studies may be due to the ethnically heterogeneous population and the large study population, and the data included an ethnically heterogeneous population. Also, there was a difference in socioeconomic status as Copenhagen was an urban area where people with a higher level of socioeconomic status lived, while the setting of the current study was a rural area where people with a lower level of socioeconomic status lived. Also, the current study results documented that the dose of oxytocin during the first stage of labor was higher in the obese women group than the normal-weight group. These findings agree with Isgren et al.’s (2021) study on “Maternal Body Mass Index and Oxytocin in Augmentation of Labor in Nulliparous Women: A
Effect of Obesity on Progress of Labor

Prospective Observational Study in Sweden”. They found that during the first stage of labor, women with a higher BMI who had their labor sped up got a higher total dose of oxytocin and a higher maximum rate of oxytocin infusion. Also, they said that the guidelines for using oxytocin infusions to speed up labor could be rethought and changed based on the woman's BMI.

Regarding the researcher's point of view, obese women were given a high dose of oxytocin to accelerate labor progress, as prolonged duration of the first stage and slow progress of labor were common among them.

Moreover, the results of the current study illustrated that there were higher complications during childbirth in obese women than in normal-weight women. Where prolonged first stage, arrest of cervical dilation, and obstructed labor were higher in the obese group than in the normal weight group, perineal tear, macrosomia, shoulder dystocia, and fetal distress were higher in the obese group than in the normal weight group.

These findings were in line with Hautakangas et al.’s (2018) study entitled” Impact of Obesity and other Risk Factors on Labor Dystocia in Term Primiparous Women at Tampere University Hospital and Rubens et al.’s (2022) study entitled “Obstetric Outcomes during Delivery Hospitalizations among Obese Pregnant Women in the United States”. Also, these findings agreed with Andele et al.’s (2023) study entitled the “Epidemiological and Prognostic Aspects of Obesity and Pregnancy in the Gynecology-Obstetrics Department at the Sylvan Olympio University Hospital Center in Lomé, Togo, in West Africa.”

All previous studies showed that labor was less common in an active phase and that the cervix was not as well ripened on arrival at the birth unit. Also, they added that a rising maternal pre-pregnancy BMI had a strong association with dystocia risk. Also, they found that obese women were more likely to have bad outcomes for their fetuses, like excessive fetal growth and fetal distress. Otherwise, they reported that cesarean section was the way of delivery for most obese women, and those who gave birth vaginally presented a tear in the soft tissues.

Additionally, these study findings were in line with Ikedionwu et al.’s (2020) study about” Pre-pregnancy maternal obesity, macrosomia, and risk of stillbirth: a population-based study” in the USA and Espitia et al.’s (2019) study about” Factors associated with fetal macrosomia” in Antioquia, Colombia. They showed that with increasing maternal BMI, the severity of macrosomia and the rates of stillbirth increased.

According to the researcher's point of view, obese women suffered a high occurrence of complications which could be attributed to the fact that obese women are more likely to have excessive gestational weight gain (GWG). This further leads to increase risk of antepartum, intrapartum, and postpartum complications. Also, this can be attributed to not receiving enough needed medical and nursing care.

Meanwhile, these study findings disagreed with Dalbye et al.’s (2021) study about “Maternal Body Mass Index and Risk of Obstetric, Maternal, and Neonatal Outcomes: A Cohort Sudy of Nulliparous Women with Spontaneous Onset of Labor in Norwegian,” which reported that no associations between maternal BMI and neonatal outcomes were observed. Also, these study findings disagreed with Durnea et al.’s (2018) study about “the Effect of Body Mass Index on the...
Effect of Obesity on Progress of Labor

Incidence of Perineal Trauma in the UK Tertiary Maternity Unit.” Which showed that increased BMI at the booking visit was associated with a reduced incidence of minor perineal trauma at delivery.

Regarding the researcher's point of view, this difference may be due to the studied women of the previous studies having a higher level of education than the studied women of the current study. Women with high educational status may have an elevated level of birth preparedness and complications readiness. Also, it may enhance the likelihood of maternal health service utilization.

Furthermore, the current study findings illustrate that obese women had a higher rate of cesarean section and a lower rate of vaginal delivery than normal-weight women. **These results were in line with** Valente et al.’s (2019) study entitled “Effect of Obesity on Labor Duration among Nulliparous Women with Epidural Analgesia at the Department of Obstetrics and Gynecology of Centro Hospitalar, São João, Portugal and Angeliki et al.’s (2018) study entitled “Maternal obesity and its association with the mode of delivery and the neonatal outcome in induced labor: implications for midwifery practice.”

They showed that obese women had a **significantly higher rate of cesarean deliveries and fewer normal vaginal deliveries**. They also said that a higher BMI was linked to a higher risk of having to start labor early or have a C-section. Also, women who were overweight and had already had a cesarean section were more likely to have another one this time around.

Additionally, the current study findings agreed with Brizan & Amabebe’s (2022) study entitled “Maternal Obesity in Prolonged Pregnancy: Labor, Mode of Delivery, Maternal and Fetal Outcomes in the Caen University Hospital Center as well as Carlhäll’s (2018) study in Sweden. They found that a higher rate of cesarean deliveries was associated with a higher body mass index.

Regarding the researcher's point of view, increase CS in obese women due to obese pregnant women were at increased risk of having macrosomic neonates. Also, failure progress of labor and the higher occurrence of complications during vaginal delivery may be factors for the increase in CS. As the physician sought to CS to prevent further complications and save the lives of mother and fetus.

In addition, the current study findings showed that there was a highly significant negative correlation between the body mass index and the cervical dilatation rate. It means that as the body mass index increases, the rate of cervical dilatation decreases.

These findings were in accordance with Shenouda et al.’s (2020) study entitled “Labor progression in obese women: are women increased with body mass index having unnecessary cesarean sections? At Victoria Hospital in London, Ontario.” They revealed that labor progresses more slowly as the maternal BMI increases. They added that obese primiparous women required an additional hour to reach full dilation of the cervix compared with their normal-weight counterparts.

From the researcher's point of view, the decreasing rate of cervical dilatation was associated with a higher early-pregnancy BMI. As high levels of cholesterol, leptin, and apelin in...
obese women blunt the effect of oxytocin on stimulating myometrial contractility and lead to immature cervix and delayed natural labor, as indicated by Liu et al. (2023) in their study about “Effects of Labor Induction in Obesity with Delayed Pregnancy: A Retrospective Study based on Chinese Obese Primipara”. Additionally, the current study findings show that there is a positive correlation between body mass index and oxytocin dose. Parallel to the present study findings, the studies that were conducted by Adams & Drassinower (2018) about “Are higher doses of oxytocin needed for obese women to achieve vaginal delivery at MedStar Washington Hospital Center and MedStar Georgetown University?” and Margarida & Madureira (2020) about “Induction of Labor in Obese Women: Is there evidence of the best method in France?” found that obese women require higher doses of oxytocin to achieve a vaginal delivery.

Regarding the researcher's point of view, when labor dystocia or failure to progress is diagnosed in obese women, augmentation with oxytocin is recommended for the induction of labor. This was indicated according to medical recommendations as oxytocin is medically indicated to promote the progress of labor and stimulate powerful contractions that help to thin and open (dilate) the cervix.

**Conclusion**

The results of this study showed that obesity was associated with slow progress of labor and prolonged duration of the first and second stages of labor, while it had no effect on the duration of the third stage of labor. This answered the first research question. Furthermore, there were statistically significant differences among the obese and normal-weight women regarding the occurrence of complications during childbirth. Where arrest of cervical dilation, obstructed labor, perineal tear, macrosomia, and shoulder dystocia were higher in the obese group than in the normal-weight group. This answered the second research question.

The current study also demonstrated that there was a negative correlation between body mass index and cervical dilation, which resulted in the failure the progress of labor and a higher rate of CS. Nearly one-half of the obese group had CS delivery, compared to only one-third in the normal weight group. This answered the third research question.

Additionally, there was a positive correlation between body mass index and oxytocin requirement. The dose of oxytocin during the first stage of labor was higher in the obese group than in the normal-weight group. This answered the fourth research question. Therefore, the current study succeeded in answering all research questions.

**Recommendations**

Based on the findings of the present study, the following recommendations are suggested:

- Encourage the maternity nurses to advise pregnant women to avoid weight gain beyond what is medically recommended (according to BMI) to avoid complications in pregnancy and labor.
- Encourage the maternity nurses to include health teaching for obese laboring women during antenatal counseling, such as a healthy diet and exercise to reduce their weight.
- Encourage the maternity nurses to use the partogram in the labor units.
- Colorful brochures regarding the negative impact of obesity on pregnancy and labor and its preventive measures are distributed
to both nurses and women to increase their awareness.

Further research:
- Several studies can be done to identify ways of reducing the negative influence of obesity on labor outcomes.
- Further research is needed to apply to large samples and in other settings.

REFERENCES


Dalbye, R., Gunnes, N., Blix, E., Zhang, J., Eggebø, T., Tokheim, L., N., & et al. (2021). Maternal body mass index and risk of obstetric, maternal and


Effect of Obesity on Progress of Labor


